

# (12) UK Patent Application (19) GB (11) 2 186 655 (13) A

(43) Application published 19 Aug 1987

(21) Application No 8702959

(22) Date of filing 10 Feb 1987

(30) Priority data

(31) 3605066

(32) 18 Feb 1986

(33) DE

(51) INT CL<sup>4</sup>

F16L 9/12 E04C 3/28 F16L 9/18

(52) Domestic classification (Edition I):

F2P 1A23A 1A3 1A8 1A9 1B5B 1B7J 1B7M C11 F23  
E1D 1073 2026 2051 2061 CA  
U1S 1706 1716 1884 E1D F2P

(56) Documents cited

None

(58) Field of search

F2P

B5A

E1D

E1W

Selected US specifications from IPC sub-classes F16L  
E04C

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## (54) Hollow profile member

(57) This invention relates to a hollow profile member produced of a plastic-fiber-mixture and having one or a plurality of hollow chambers extending in the longitudinal direction of the hollow profile member, wherein into the wall of the hollow profile member a reinforcement element 3 of an inextensible material is embedded.

In order to create a hollow profile member which is capable to withstand a high inner pressure and which has a very low weight as the reinforcement element 3 a flat tape like reinforcement element is used wherein the tape like reinforcement element is provided with perforations or through holes 6a, 6b and wherein at the opposing ends of the reinforcement element interengaging projections 7 are formed so that no interruptions within the reinforcement element is created. The hollow profile member can be used as a cold water tubing or a hot water tubing if at least the inner wall of the hollow chamber of the hollow profile member is covered with a blocking layer 4 for blocking gases.

The blocking layer 4 may be an ethylene-vinyl alcohol co-polymer.

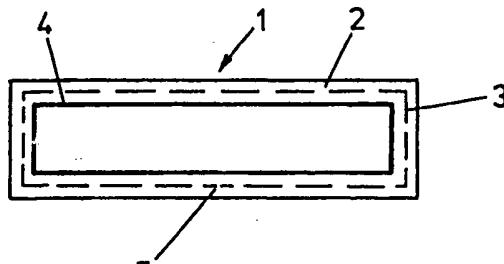


Fig. 1

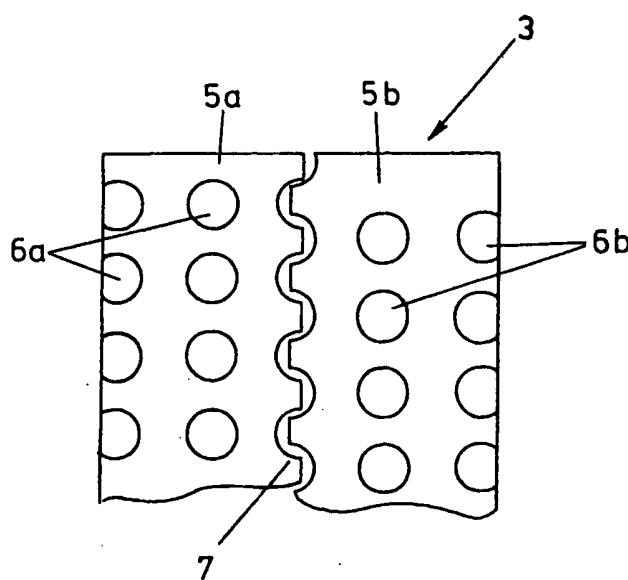


Fig. 2

**The plastic-fibre material may be  
P.V.C.-wood. The element 3 may be  
apertured metal sheet, wire grid or  
coarse mesh textile. The member  
may be incorporated into balconies  
or floors.**

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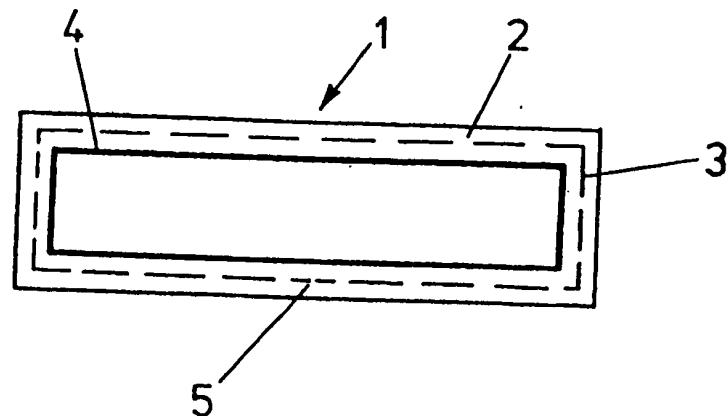


Fig. 1

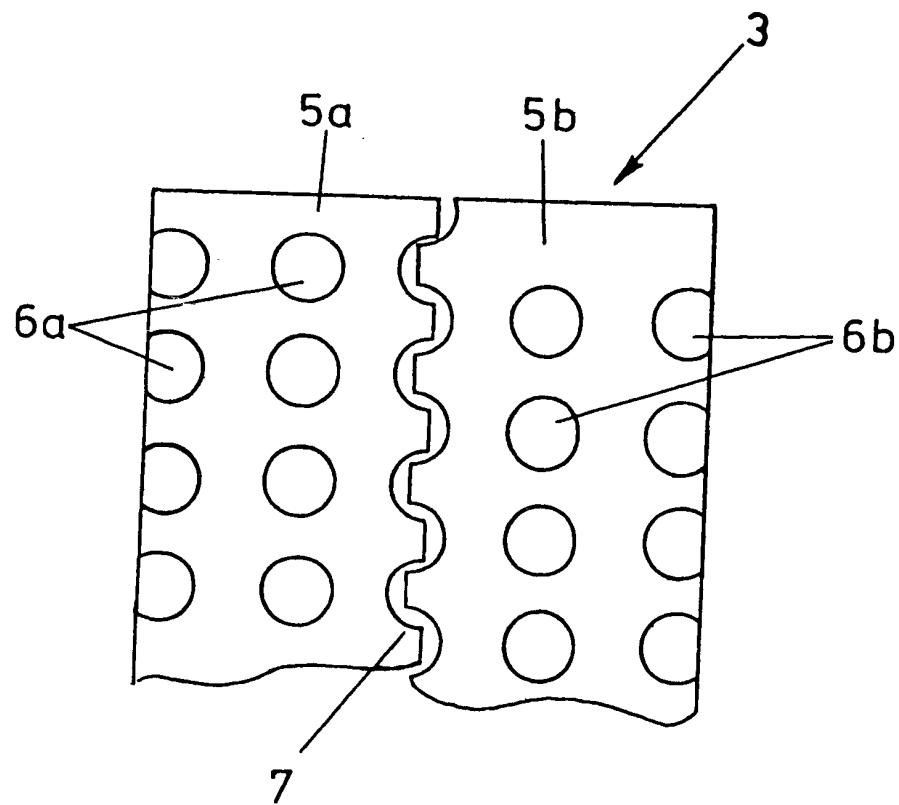


Fig. 2

## SPECIFICATION

### Hollow profile member

- 5 This invention relates to a hollow profile member made of a plastic-fiber-mixture and having one or several hollow chambers extending in the longitudinal direction of the hollow profile member, wherein at least into the outer wall  
 10 10 the hollow profile member a reinforcement element of an in-extensible material is embedded so to extend over the whole length of said hollow profile member.

In the German Patent Application P 35 07

- 15 640.2 a method is described for producing reinforced profile members according to which at first a hollow profile member having one or several hollow chambers is produced according to an extrusion process and then into said  
 20 20 at least one hollow chamber of the hollow profile member a reinforcing hardenable plastic filling is introduced and simultaneously with the introduction of the lastic filling at least one reinforcement element of an in-extensible material and extending over the whole length of the profile member is embedded. The material of the plastic filling can be comprised of a plastic-wood fiber mixture so that the profile member has a reduced weight.  
 25 30 In order to obtain a fixed mounting position of the reinforcement element within the plastic-filling said reinforcement element can be provided with corrugations or grooves at the outer surface thereof which are extending in a direction transversely to the longitudinal direction of the reinforcement element.

Furthermore at least one reinforcement element is provided within the profile member in such a position that with a bending stress

- 40 acting on the profile member transversely to the longitudinal direction thereof said reinforcement element is subjected to a tensile load.

With this specific performance of the profile member the bending resistance of the profile  
 45 member can be substantially improved so that such profile members can be used to form balconies producing balcony floors, but also to construct floor coverings.

However, such profile members can still not  
 50 be used to conduct a liquid or gas like fluid within the interior thereof which is kept on a relatively high pressure.

From the DE-OS 28 27 851 a building profile member is known in particular a profile  
 55 member for producing window frames with which the hollow profile member is comprised of a thermoplastic material like PVC and into the hollow chambers of the hollow profile members a filling including a plastic-matrix is introduced. The basical feature of this known building-profile member consists in that the said filling comprises a matrix of methylmethacrylate includina hollow silicate balls as fillin-

threads in particular glass threads are embedded in the longitudinal direction.

From GB-PS 12 98 823 a method for producing a profile member is known with which over the cross section of the profile member two different types of plastics are provided so that an outer layer is comprised of a thermoplastic material whereas the inner core is comprised of a duro plastic. However, a reinforcement element is not used with this known profile member.

It is therefore an object of the present invention to provide a hollow profile member made of a plastic-fiber mixture which has

- 80 especially a low weight and can easily be manufactured and is capable to withstand a high inner pressure and wherein such hollow profile member should also have excellent thermal insulation characteristics.

- 85 Starting out from the hollow profile member made from a plastic-fiber mixture as defined at the beginning of the specification the said object is solved according to the invention in that

- 90 a) said plastic-fiber mixture is comprised of a plastic-wood fiber mixture,  
 b) the reinforcement element is comprised of a flat, tape like reinforcement material,  
 c) the tape like reinforcement material is  
 95 provided with through holes, and  
 d) the opposing ends of the tape like reinforcement material are provided with interengaging projections.

By using the plastic-fiber mixture in the form  
 100 of a plastic-wood fiber mixture the whole weight of the hollow profile member can be kept comparatively low.

By the use of a flat tape like reinforcement element a substantial mechanical reinforcement  
 105 of the hollow profile member in particular of the outer walls of the hollow profile member is obtained wherein an intimate connection between the material of the hollow profile member and the reinforcement element is achieved  
 110 by the through holes which are provided in a great number within the reinforcement element. These through holes can have any desired shape that means they can be rectangular, slot like or circular.

- 115 As tape like reinforcement element a basis material is used which is extending in one plane. This tape like reinforcement material is then bent into the cross section shape of the corresponding hollow profile member so that with necessity the two ends (end portions) are opposing each other so that at this point of the reinforcement element an interruption is created based on the manufacturing method.

In order to effectively cancel this interruption  
 125 according to the present invention the opposing ends of the tape like reinforcement material are provided with interengaging projections so that also at the end portions of the

- Very manifold application possibilities are resulting if a blocking layer for blocking gases is provided at the inner wall surface of the at least one hollow chamber. The hollow profile member can then be used for example as a tubing for supplying gases or liquids wherein also high inner pressures are possible.
- Furthermore an improved embodiment of the present invention consists in that also the outer surface of the hollow profile member is provided with a blocking layer for blocking gases. These blocking layers can be comprised for example of an ethylenevinylalcohol-copolymer (EVOH). This specific new plastic material which has the trade name "CLAREN" (trade mark) has excellent blocking characteristics against O<sub>2</sub>, CO<sub>2</sub> and further gases. Such copolymerisates can in particular be used for the coextrusion of foils, tubings—in combination with polyolefines, polyesters and other plastics.
- This specific plastic has a very high blocking action against dry gases, can be easily machined and is resistant against greases, oils and a great number of chemical substances, is also resistant against UV radiation, has a very small electrostatical charge and is physiologically harmless.
- A hollow profile member which is covered by such a blocking layer (within the interior and/or on the outside) therefore can be used as a cold water tubing and a hot water tubing and additionally such hollow profile member has also an excellent thermic isolation capability.
- The hollow profile member can have a rectangular cross section including a plurality of juxtaposed hollow chambers or it can have a circular cross section having a single hollow chamber or can have a plurality of hollow-chambers which are separated by partitions.
- The reinforcement element can be comprised of a sheet respectively sheet metal element which is provided with a plurality of through holes or borings.
- The reinforcement element can also be comprised of a wire grid or can be comprised of a textile good.
- The material of the reinforcement element can be comprised of different metals, metal alloys or also of a particular hard plastic material having a small extensibility.
- An additional reinforcement of the hollow profile member against bending forces can be obtained by embedding into the wall of the hollow profile member additional fiber like or thread like reinforcement elements. The plastic of the plastic-wood fiber mixture can suitably be comprised of polyvinylchloride (PVC).
- In order that the invention may be fully understood an embodiment will be described by way of example and with reference to the

invention; and

Fig. 2 a partial view of a reinforcement element which is used in the hollow profile member according to Fig. 1.

- 70 In Fig. 1 a hollow profile member according to the present invention is commonly designated with reference number 1 and this hollow profile member has a rectangular cross section. The material of the hollow profile member is comprised of a plastic-wood fiber mixture 2 and into this material a reinforcement element 3 is embedded which has been prefabricated before manufacturing the hollow profile member from a flat sheet member.
- 75 80 With the shown embodiment the inner wall surface of the hollow profile member is provided with a blocking layer 4 for blocking gases, wherein this blocking layer can be formed afterwards for example by conducting a blocking material in a liquid form through the hollow profile member so that a layer is formed on the inner wall surface which is then hardened or by producing the blocking layer 4 with application of the coextrusion process.
- 85 90 It should be referred to the fact that in order to obtain a common protection against corrosion also on the outer surface of the hollow profile member a further blocking layer (not shown) can be provided. With this last mentioned embodiment the material of the hollow profile member is enclosed from all sides by a protecting blocking layer.
- 95 100 The plastic material of the used plastic-fiber mixture can be comprised for example of polyvinylchloride, whereas the fibers can be comprised of wood fibers which have a length in the order of 0,5 to 5 mm.
- 105 110 In Fig. 2 the end portion of the reinforcement element is shown in a side view wherein this end portion is designated with reference number 5 in Fig. 1. At said end portion the two ends 5a and 5b of the reinforcement element 3 are opposing one the other. In order to avoid that with this opposing area an interruption of the reinforcing action is created the said ends 5a and 5b are provided with projections 7, respectively, wherein between these projections semicircular recesses are performed. Thus the possibility is created that the projections can cam like interengage one into the other so that no interruption of the reinforcement element is created.
- 115 120 125 With the embodiment shown the reinforcement element is comprised of a sheet member having a plurality of openings or holes 6a, which are arranged in a predetermined level (lines) one above the other and having also openings or holes 6b (at the other end 5b) which are arranged on a different level with respect to the openings 6a also in a plurality of superimposed lines.

As a reinforcement element suitably a by-product can be used which is remaining with the production of washers which are produced by punching. The only presupposition consists in that the punching holes must be provided into the sheet along a plurality of lines which are displaced one towards the other in longitudinal direction so that automatically end portions are created which have the projections 7 and which are separated by semicircular recesses one from the other.

- By the displaced arrangement of the projections 7 at the one end portion 5a opposite to the projections at the other end portion 5b 15 the two ends 5a and 5b can be put together so that the respective projections on the one end are projecting cam like into the recesses at the opposing end portion 5b. Thus into the material of the hollow profile member a reinforcement element can be embedded such 20 that no interruption within the reinforcement element is created.

The reinforcement element 3 can be produced as well from a sheet member as for 25 example an aluminium sheet, copper sheet, iron sheet, but also in case of a desired high quality of steel sheet.

Furthermore there exists also the possibility 30 to produce the reinforcement element 3 from a wire fabric or a wire sieve. A further possibility consists in that to produce the reinforcement element from a coarse mesh textilegood.

It should be referred to the fact that with 35 using a non extensible material for the reinforcement element in each case a basical increase of the stiffness of the hollow profile member will be obtained if the reinforcement element—as can be seen from the embodiment—is embedded at a position within the 40 material of the hollow profile member so that the reinforcement element is tensil loaded with a bending force acting on the hollow profile member.

A further embodiment consists in that a further fiber like or thread like re-inforcement element is additionally embedded into the material of the hollow profile member (for example into the partitions) wherein this fiber like or thread like reinforcement element can 50 also be comprised of twisted fibers or twisted threads.

Tests have shown that a hollow profile member performed according to the present invention can withstand a very high inner pressure and is equivalent to an iron tubing.

Therefore the hollow profile member according to the present invention can be used as a cold water tubing or as a hot water tubing or as a combination hot and cold water tubing. 60 According to a preferred embodiment (not shown) the hollow chamber provided for transporting the cold water can be separated from the hollow chamber of the tubing for the hot

between cold water and hot water can be realized.

A lot of changes and embodiments are obvious for a man skilled in the art without leaving the scope of the present invention. There exists the possibility to perform the hollow profile member as a multi-tubing having a circular cross section, respectively, wherein the individual tubings are connected together by a single connecting wall so that the possibility is created to separate individual tubings with laying of the multi-tubing by cutting through the connecting wall between two tubings.

## 80 CLAIMS

1. A hollow profile member formed of a plastic-fiber mixture having one or a plurality of hollow chambers extending in the longitudinal direction of the hollow profile member 70 wherein at least into the outer wall of the hollow profile member a reinforcement element of an inextensible material and extending over the whole length of the hollow profile member is embedded, comprising the features 85
  - a) said plastic-fiber mixture is comprised of a plastic-wood fiber mixture (2),
  - b) said reinforcement element (3) is comprised of a flat, tape like reinforcement material,
  - c) said tape like reinforcement material (3) is provided with through holes (6a, 6b),
  - d) the opposing end portions (5a, 5b) of said tape like reinforcement material (3) are provided with inter-engaging projections (7).
2. A hollow profile member according to claim 1 in which on the inner wall of said at least one hollow chamber a blocking layer (4) for blocking gases is provided.
3. A hollow profile member according to claim 1 or 2, wherein on the outer surface of said hollow profile member (1) a blocking layer for blocking gases is provided.
4. A hollow profile member according to claim 2 or 3, wherein said blocking layer (4) is comprised of a ethylen-vinylalcohol-copolymer.
5. A hollow profile member according to one of the preceding claims, wherein said hollow profile member (1) has a rectangular cross section.
6. A hollow profile member according to claim 5, wherein said hollow profile member (1) is formed by two hollow chambers which are separated by a partition one from the other.
7. A hollow profile member according to one of claims 1 to 4, wherein said hollow profile member has a circular cross-section.
8. A hollow profile member according to one of the preceding claims, wherein said reinforcement element (3) is comprised of a sheet member having a plurality of through holes or borings (6a, 6b).

ment element (3) is comprised of a wire grid.

10. A hollow profile member according to one of claims 1 to 7, wherein said reinforcement element (3) is comprised of a textile-

5 good.

11. A hollow profile member according to one of the preceding claims, wherein into the wall of said hollow profile member (1) additionally a fiber like or thread like reinforcement

10 element is embedded.

12. A hollow profile member according to one of the preceding claims, wherein the plastic material of said plastic-wood fiber mixture is comprised of polyvinylchloride (PVC).

15 13. A hollowprofile member according to one of the preceding claims, wherein said hollow profile member is used as a cold water and hot water tubing.

20 14. A hollow profile member according to claim 1, substantially as described in conjunction with the accompanying drawing.

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Printed for Her Majesty's Stationery Office  
by Burgess & Son (Abingdon) Ltd, Dd 8991685, 1987.  
Published at The Patent Office, 25 Southampton Buildings,  
London, WC2A 1AY, from which copies may be obtained.